

ductor varies inversely as the distance from the conductor. On p. 83, merely as a footnote, we get a simplified version of Minchin's formula for the total flux through a coil of circular cross-section, and on p. 85 Perry's formula for the flux through a coil of rectangular cross-section. On p. 87 we find the well-known formula for the induction in the centre of a long solenoid, but in none of these cases is a proof given.

This tendency to do without mathematical reasoning is surely futile; a reader who does not know even the small amount of mathematics which suffices for the elementary study of electricity had better leave the subject alone; and the reader who has the required mathematical knowledge is not helped by finding the most simple relations set forth in long tables and perfectly obvious diagrams. Yet the book is interesting to the man who knows the subject. He will find many things, which are treated in all text-books in the orthodox way, presented in a different manner, and although the treatment is sometimes rather verbose, it is at any rate original. As regards nomenclature, the originality is perhaps carried a little too far. That the term "kelvin" is used to denote the unit ordinarily called the kilowatt-hour might be passed over as permissible, since some other authors have adopted the same term, though it is by no means generally accepted; but there is no justification for introducing the term "siemens" for the watt-hour. This unit is hardly ever used, and to coin a special term for it is quite unnecessary. The terms "continuous electricity" and "alternating electricity" are also unusual, whilst the abbreviation "ats" for ampere-turns is not very happily chosen.

The first six chapters, dealing with the specific resistance of conductors, the conception of current, voltage, energy, power, and explaining Ohm's law, are very elementary. The definition of the unit of energy, taken as the kilowatt-hour, is unusual. According to the author's nomenclature, the "kelvin" is that amount of energy which will raise the temperature of a ton of water by 0.86° C. This is surely a round-about way for a book on electricity, especially as the conception of the mechanical equivalent of heat is not used to connect the "kelvin" with the "joule," but the relation between the two units is simply stated in a table.

The following chapters deal with the magnetic field, the E.M.F. generated in moving conductors, alternating currents, inductance, the magnetic circuit, and insulating materials. The passage dealing with the relation between time and current in a circuit to which an E.M.F. is suddenly applied is an object-lesson of the futility of attempting to treat such a subject without mathematical basis. It cannot be done; and thus we find Helmholtz's formula suddenly introduced without any proof, and then worked out at great length algebraically for a special case. Then we get to the time constant and more numerical calculations, with the usual complement of tables and curves. The best chapter in the whole book is that on insulating materials. Here we get on to the solid ground of experimental evidence. Tables and curves are given

for the disruptive strength of a great variety of insulating materials, the influence of temperature is discussed, as are also the methods of testing for disruptive strength and the thickness of slot insulation found necessary from practical experience. The specialist who has to design high-pressure machinery will find this part of the book very useful.

GISBERT KAPP.

AN ARTIST-ORNITHOLOGIST IN EGYPT.

Egyptian Birds, for the Most Part seen in the Nile Valley. By Charles Whympers. Pp. x+221; with 51 coloured plates. (London: A. and C. Black, 1909.) Price 20s.

WE have nothing but praise for Mr. Whympers' drawings. Being more in the nature of landscapes with birds in the foreground than figures of birds with a suitable background, they naturally gain from an artistic standpoint, and this has not detracted from their value as guides towards identification. Many of the drawings are, indeed, most pleasing pictures, and convey a delightful impression of the surroundings amongst which the visitor to Egypt may expect to see the birds depicted. On the whole, Mr. Whympers has not suffered greatly at the hands of the block-maker, though we may remark generally that the colouring of the plates is more pleasing by artificial light than by daylight, and we imagine that the green legs and feet of the griffon vulture, the purple hues of the chats, and such like inaccuracies in colouring are due to the engraver's or printer's art rather than to the artist's.

Whether the author has been wise in his choice of "types" of Egyptian birds—only some fifty or sixty species in all are figured and described—is perhaps a matter for argument, but in a book which aims at teaching the traveller in Egypt "something of the birds he sees," it seems a waste of opportunity to devote plates and descriptions, amongst so few, to such birds as the kingfisher, house-sparrow, heron, snipe, and lapwing, which every Englishman who takes the smallest interest in birds must know; while the inclusion of the shoebill, which has never occurred in Egypt, because it is a favourite at the Giza Zoological Gardens, is really absurd—one might as well include the giraffe in an account of the mammals of England! The use of the book as an aid to identification is thus very small, for it will help the average Englishman to identify barely forty birds which he does not already know, and the volume is a large one for so small a gain in knowledge.

Turning now to the letterpress, the author disarms minute criticism by his statement that the book is not intended for the ornithologist, but he implies that its purpose is, in some measure at all events, educative, so that we may fairly point out some inaccuracies, for we cannot commend the author's ornithology in the same spirit as we can his art. As an example, we may direct attention to the description of the crested lark, in which not a word is said of there being a number of well-marked geographical races of this bird peculiar to different localities in Egypt—obviously a very interesting point which, had it been explained,

would have caused Mr. Whympers's readers to look carefully at the crested larks they saw instead of passing them over as "nearly the commonest birds." Which form is represented in the plate it is difficult to say, but certainly neither the almost black *Galerita cristata nigricans* of the Delta nor the pale, sandy-coloured *G. c. altirostris* found to the south of Cairo could be recognised from the drawing.

Again, on p. 76 the extraordinary statement is made that the red-spotted bluethroat has never occurred on migration in Germany, and that it flies without a halt from Africa to Scandinavia. Because many of the migrants which occur in winter in Egypt are of the same species as those which occur in north-western Europe in summer, it is unreasonable, we think, to suppose that they are the same individuals. The further statement that the bird is but an accidental visitor to Great Britain, and hardly worthy of a place on the list of our birds, should also be corrected, since it has been proved during the last ten years, at all events, to be a regular annual bird of passage in the autumn. We have no wish to criticise unduly, but we think it behoves an author to be even more careful of his facts in a popular book of this kind than in a book intended for readers who would not be so likely to accept his statements unchecked.

The ornithologist reading Mr. Whympers's pages may cull a few observations of interest, such as a note here and there on the winter habits of some of the migrants. The list of birds at the end of the volume is so far from being complete that we cannot think that it has been revised by Mr. M. J. Nicoll, who is credited with having assisted the author in making it 'as complete as possible.'

THE EVOLUTION OF AGRICULTURE.

Die Entstehung der Pflugkultur. By Dr. Ed. Hahn. Pp. viii + 192. (Heidelberg: C. Winter, 1909.) Price 3.60 marks.

IN the study of culture-origins there seem to be three working hypotheses. According to one, institutions and material inventions were, so to speak, "forced" upon man by the various exigencies of his life. "Necessity is the mother of invention." According to another, religion, or rather magic, initiated such steps in progress. A third combines these; a step when made was enabled to persist and be improved by the influence of religion.

But each of these hypotheses, as others, takes into account the psychological factors. How did the idea of an invention occur? It is the first step that counts; given the first step, for instance, in the evolution of the bow, and the rest is easy. How, then, did man hit upon the first step? Among the conditions to be posited are "play" and accident. There is a good deal to be done in the investigation of the first steps of what may be called the primary inventions.

Dr. Eduard Hahn has written many volumes and papers on economic history and culture-origins. He is a suggestive writer, and is always ready with

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a comparison between modern and primitive "diapasons," in Lamprecht's phrase for social atmospheres. The present volume is more or less supplementary, as an answer to criticisms of his theory of the origins of agriculture.

This theory is the magical-religious. It has been severely criticised, and we must admit that in this re-statement and defence Dr. Hahn fails to convince. His method is almost as elliptic as Prof. Adolf Bastian's. A closely reasoned argument confined to one detail, for instance, the relation of the "Moon Goddess" to the evolution of husbandry, and employing careful analogies when a step is taken from one people to another, or from one culture-stage to another, would have had better results. But he seems to rely on the cumulative effect of data which are of the most diverse nature and value. Thus we have in unequal yoke a piece of folklore from Hesiod or Macrobius, with a savage practice of the Australian Arunta and a German peasant custom. But his theory is too fanciful to be able to rely on such data.

The points of the theory are mainly these: the basis of primitive subsistence was vegetable, not animal. The three-stage hypothesis of hunting, herdsman-ship, and husbandry is traversed. The primitive *Hackbau* is distinguished from agriculture proper, *Pflugbau*. Woman was the chief agent in primitive economics, as the "gardener" with her digging-stick. Thus far the theory is sound. But it proceeds to urge the "religious" origin of the domestication of animals, of the use of milk, of the wagon and its wheels, and of the plough, all in connection with the cult of the Moon. Much is made of the sporadic indications of the connection of phallicism with the "idea" of ploughing.

Dr. Hahn's sketch of the primitive symbiosis of Headman, Medicine-man, and Woman is good reading. The Medicine-man protects the primitive "crop" from ghostly enemies, and secures for it ghostly strength. The Headman organises material defence, and, when free, the ordinary male hunts. But primitive society was probably not quite like that; in particular it is easy to exaggerate the influence of "religion."

A. E. CRAWLEY.

OUR BOOK SHELF.

A Manual of Locomotive Engineering. By W. F. Pettigrew. Third edition, revised. Pp. xv + 356. (London: C. Griffin and Co., Ltd., 1909.) Price 21s.

WE had pleasure in noticing the first edition of this book some ten years ago, when a favourable opinion was expressed as to its value as an educational means of assisting students of locomotive engineering in its many phases.

The author claims to have brought the work thoroughly up to date, and, considering the tremendous advances made in this branch of engineering during the last ten or more years, we naturally expect some evidence of really modern practice in the third edition. It is very disappointing to find this is not the case. Plate i. illustrates what the author describes as "the new outside cylinder express engines designed by Mr. W. Adams," &c. As Mr. Adams joined the majority